Appendix F: Cost Development Protocol

COSTS TABLES

A standardized method was developed to assign costs to recovery actions. The assumptions are based on CDFW's "Cost and Socioeconomic Impacts of Implementing the California Coho Recovery Strategy" (2004) and NMFS "Habitat Restoration Cost References for Salmon Recovery Planning" (2008). These references provided the range of cost for recovery actions such as passage, monitoring, habitat complexity, etc. While there is a wide degree of uncertainty in the reference documents, they, in addition to other information considered and adjustments for inflation and location, provided the best available supporting information for these estimates. NMFS further assessed additional information such as aggregate costs, wage rates, and socioeconomic impacts and created assumption tables for specific categories of actions and action types. NMFS did not include permitting costs, as they are highly variable based on location, type of actions, and permits required.

The following tables were used to assign costs to specific action steps for the population specific implementation tables. Costs have been adjusted to reflect inflation rates (using a standard 3.3% annual rate, for 2014).

Table 1. Recovery Implementation Cost

Action	Sub-Category	Cost ($)	Unit
Stream Complexity	Large Wood Placement	26,000	Mile
	Engineered Log Jam	104,000	ELJ
	Spawning Gravel	32.94	cubic yard
Vegetative Ground Cover	Riparian Planting	20,719	Acre
	Riparian Thinning	1,468	Acre
	Invasive Species Control	41,000[1]	Acre
Floodplain Connectivity	Alcoves, Side-Channels	37,200	Acre
Sediment Control	Road Inventory	957	Mile
	Erosion Assessment	12.62	Acre

[1] Cost for treating non-native species in freshwater and riparian environments.

Fish Passage & Protection	Fish Screen	53,465	Screen
	Culvert Replacement	230,411	Culvert
Estuarine Ecology[2]	Estuarine Restoration	41,000	Acre

[1] Source: CDFG 2004 (p. 1-16)
[2] Source: NMFS 2008, p. 43-44

Estimates in the above table were used as a standard when a recovery action lacked specificity. For example, if a recovery action called for improving riparian cover and could not specify the acreage or type of riparian plants to revegetate, then the standard of $20,719/acre was used to calculate the cost for that action step. In rare instances, detailed information may have been available. When this occurred, estimates from NMFS (2008) and CDFW (2004) were used. Below are tables of estimates for certain types of recovery action steps.

Table 2. Floodplain and Tributary Reconnection ($/acre)[1]

Materials	Extent of Earth Moving		
	Minimal	**Moderate**	**Substantial**
Minimal	8,721	17,442	40,698
Moderate	17,442	29,070	58,140
Substantial	40,698	58,140	81,395

[1] Source: NMFS 2008, p.26

[2] No references are available for specific estuarine restoration projects targeting salmonid habit conditions. NMFS estimate based on large wood placement and wetland/riparian planting per acre.

Table 3. Riparian Planting ($/acre)[1]			
Materials/Site Accessibility	**Level of Site Preparation***		
	Flat/Light Clearing	**Avg. Slope/Avg. Clearing**	**Steep/Heavy Clearing**
Low Cost	17,442	40,698	93,023
Medium Cost	26,163	63,954	110,465
High Cost	46,512	78,488	1,366,279

[1] Source: NMFS 2008, p. 32

Table 4. Upslope Riparian Thinning[1]	
Type	**$/acre***
Mechanical	876
Hand 15-30% slope 40-60% cover	928
Hand 30-50% slope 60-90% cover	1,237
Chemical	155
Average	799

[1]Source: NMFS 2008, p. 64

Table 5. Road Inventories[1]	
Location	**$/mi**
Humboldt County	829
Eel River	538
Mattole River	635
Russian River	936
Salmon Creek	1068
Gualala River	837
Avg. all Inventories	807

[1]Source: NMFS 2008, p. 61

Table 6. Erosion Assessments[1]	
Location	**$/acre***
Humboldt County	9.5
Del Norte County	11.9
Average all assessments in CA**	10.7

[1]Source: NMFS 2008, pg. 61

Table 7. Removal of Invasive Plant Species[1]		
Species	**$/acre***	**Source**
Arundo	29,762	Neil 2002
Himalayan Blackberry	990	Bennet 2007 (avg)
Purple Loosestrife and Water Chestnut	361	USFWS 2001
Pepperweed and Giant Reed	1,000	Northern California Conservation Center 2010
Average (excluding outlier of Arundo)	784	

Establishing a Multiplier

The recovery costs established by CDFW in 2004 and NMFS in 2008 were standardized for the CCC coho salmon ESU and portions of the SONCC coho ESU, which include Del Norte to Santa Cruz counties. For the Coastal Multispecies Recovery Plan, recovery costs were not standardized across the diversity strata due to the variability between each of the regions, such as extent of urbanization, labor wages, access, and material costs. To attempt to encapsulate the anticipated increased cost of implementing recovery actions, NMFS applied a multiplier of 1.20 to the standard costs for the San Francisco Region, and a multiplier of 1.14 in the Central Coast Region to reflect the variability in wages between the regions. It is uncertain if this will apply in all circumstances, watersheds, or recovery actions.

Table 8. Multiplier of Recovery Cost to Regions: North Central Coast Office	
Region	**Multiplier**
North Coast	none
San Francisco Bay	1.20
Central Coast	1.14

Recognizing Uncertainty

While NMFS utilized the best available reference documents, evaluated a variety of other sources (including suggestions from co-managers), and applied inflation and location adjustments, we recognize there is uncertainty in the estimation of the costs associated with implementing recovery actions. It is our hope that the costs associated with recovery implementation will be repaid in full when the benefits of healthy salmon and steelhead populations are evaluated.

Healthy salmon and steelhead populations provide significant economic, societal, and environmental benefits (Baker and Quinn-Davidson 2011, Nieme *et al.* 1999). Entire communities, businesses, jobs, and even cultures have been built around salmonids in California (Michael *et al*. 2010, Nieme *et al*. 1999, Southwick Associates 2009). Monetary investments in watershed restoration projects can promote the economic vitality in a myriad of ways. In addition, viable salmonid populations provide ongoing direct and indirect economic benefits as a resource for fishing, recreation, and tourist-related activities (Michael 2010). Dollars spent on salmonid recovery will promote local, state, Federal, and tribal economies, and should be viewed as an investment that yields a spectrum of valuable returns (Nieme *et al.* 1999, Southwick Associates 2009).

Importantly, the general model for viewing cost versus benefits should be viewed in terms of long-term benefits derived from short-term costs. Salmonid recovery is an investment and opportunity to diversify and strengthen the economy while enhancing the quality of life for present and future generations. The dollars necessary to recover salmonids should be made available without delay such that the suite of benefits can begin to accrue as soon as possible.

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